

Attorney Docket No. WSP241US
U.S. Patent Application No. 10/557,620
Official Action Dated July 24, 2008
Date: December 19, 2008

In the Drawings

Please delete the current sheets of drawings and substitute the enclosed three (3) replacement sheets of drawings.

Remarks

This is in reply to the official action of July 24, 2008.

The Examiner has objected to the drawings on the grounds of existing textual material and hand written figures.

While neither of these are valid reasons for drawing objections (See MPEP 608.02(b)I), substitute drawing sheets are provided that incorporate type style numbers and eliminate textual material as shown in the enclosed annotated sheets. In the annotated sheets, textual material is shown as crossed out and added numbers are circled. No new matter is added.

Clean and marked up copies of a substitute specification are provided to include appropriate sections. No new matter is added.

Pending claim 1 has been rejected under 35 U.S.C. 112 on the ground that the instant claims are enabled only for polymeric methacrylamide. The claims have been limited to inclusion of polymeric methacrylamide.

The Examiner has further rejected claim 1 on the ground that it is not clear what “breaking open the enclosing water” means. There is no doubt that it means that water enclosing the soil particle is broken open. There is no possible ambiguity. The Examiner is referred to page 2, line 9 of the specification that says: “Introduction of the additive according to the invention into the soil mixture, by virtue of the water casing which generally surrounds the individual grain being broken open, obviously results in better coagulation by virtue of the stronger adhesion forces with which the individual particles of the soil can adhere to each other after their water casing has been broken....”

The examiner has also objected to the phrase “soil, preferably argillaceous material and/or course clay” as being indefinite as to whether it is soil or argillaceous material. Again there is no ambiguity. “Soil” is generic to both “argillaceous material” and “clay”. The Examiner is referred to the definition of soil in “McGraw Hill’s Dictionary of Scientific and Technical Terms”, 2nd Edition, 1978, pages 101 and 1489. “Argillaceous” – “Of rocks or sediments made of or largely composed of clay-size particles or clay minerals.” and “Soil”- “unconsolidated rock material over bedrock”

There is no ambiguity and the rejection should be withdrawn.

The Examiner has also objected to claim 1 on the ground that a “preferred” alternative is included in the claim. The claims have been amended to overcome the rejection.

The Examiner has also objected to claim 1 on the ground that there is insufficient antecedent basis for “the enclosing water” and “the grain” in the claim. These objections have been overcome by amendment.

Reference to the “means” terminology objected to by the Examiner has been removed from the claims. The objection is therefore moot.

In view of the foregoing amendments and remarks, all rejections under 35 U.S.C. 112 should now be withdrawn.

Claim 1 has been rejected under 35 U.S.C. 103 as being unpatentable over either U.S. Patent 6,340,385 to Wammes or U.S. Patent 4,964,918 to Brown et al.

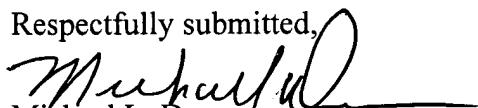
Neither of these references teach or suggest any method or use of any composition or mixture by injection into a construction for any purpose.

Wammes teaches away from the present invention in that it teaches forming a gel. Gels as described by Wammes have a water matrix which is exactly contrary to the highly consolidated material used in the present invention where water surrounding soil particles is broken apart. This is similarly true of Brown et al.

All rejections should be withdrawn.

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In view of the foregoing amendments and remarks, it is submitted that all claims are now in condition for allowance, which action is courteously requested.

Respectfully submitted,

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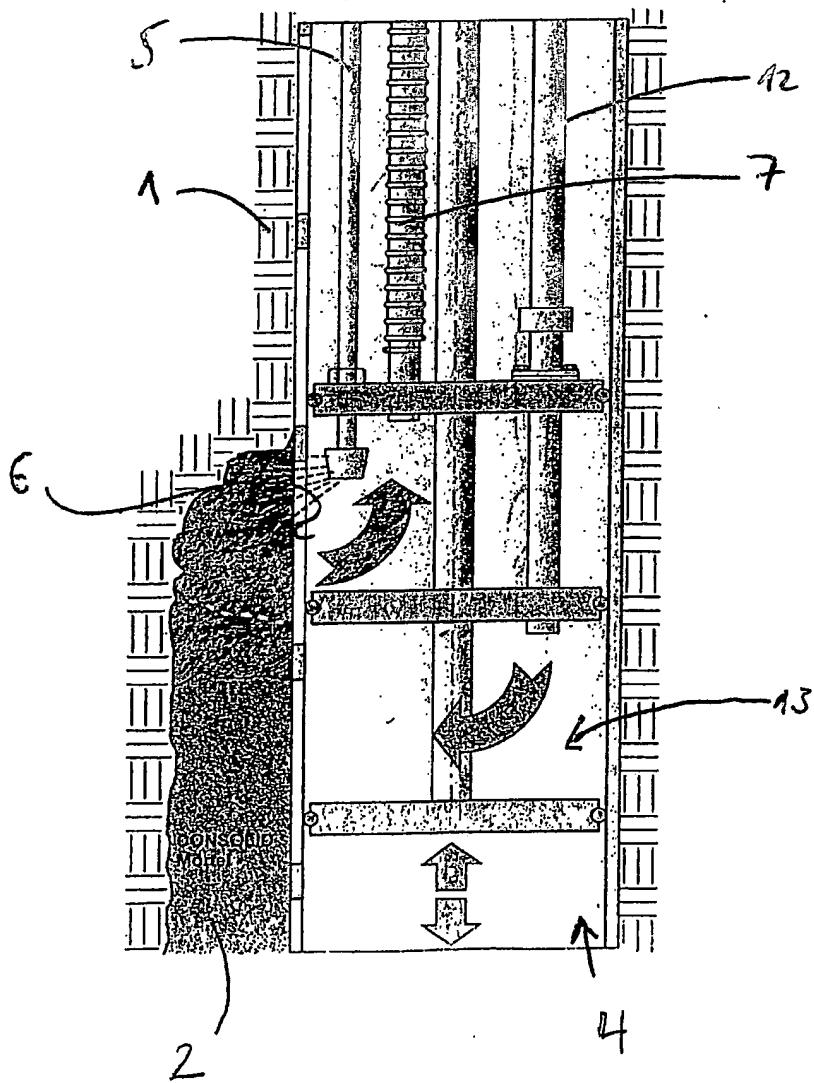
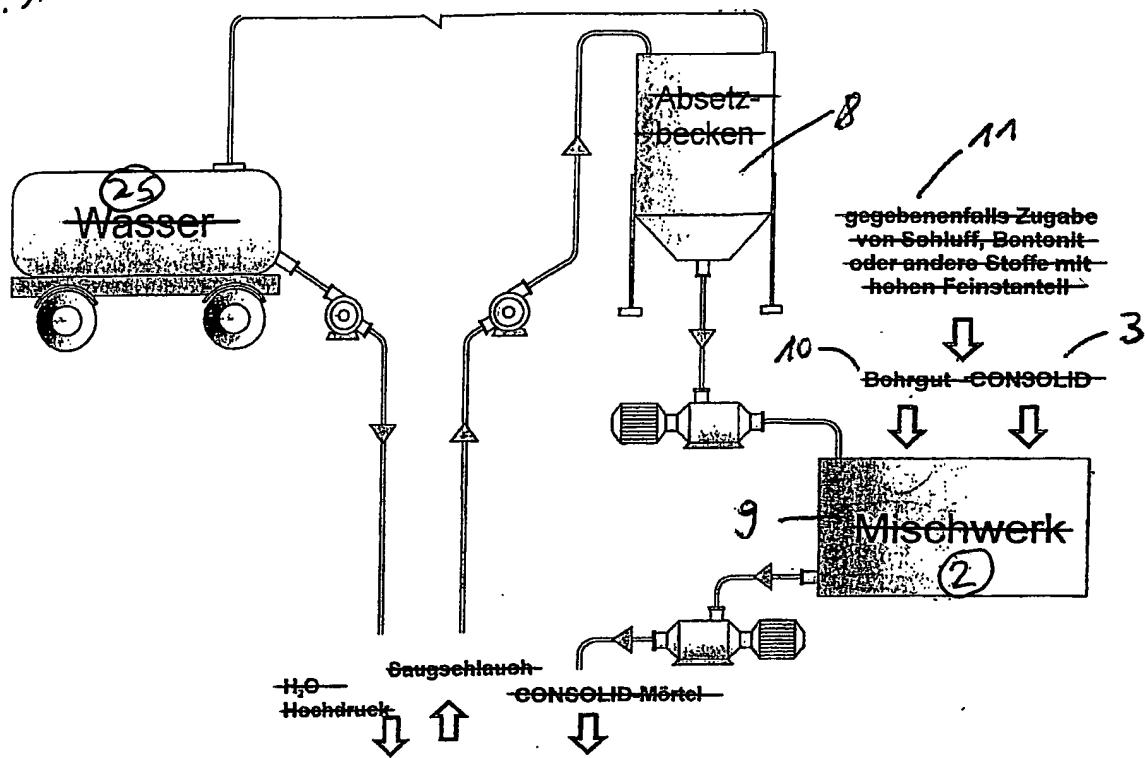
Annotated Sheet

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Fig. 1



Annotated Sheet

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Fig 2

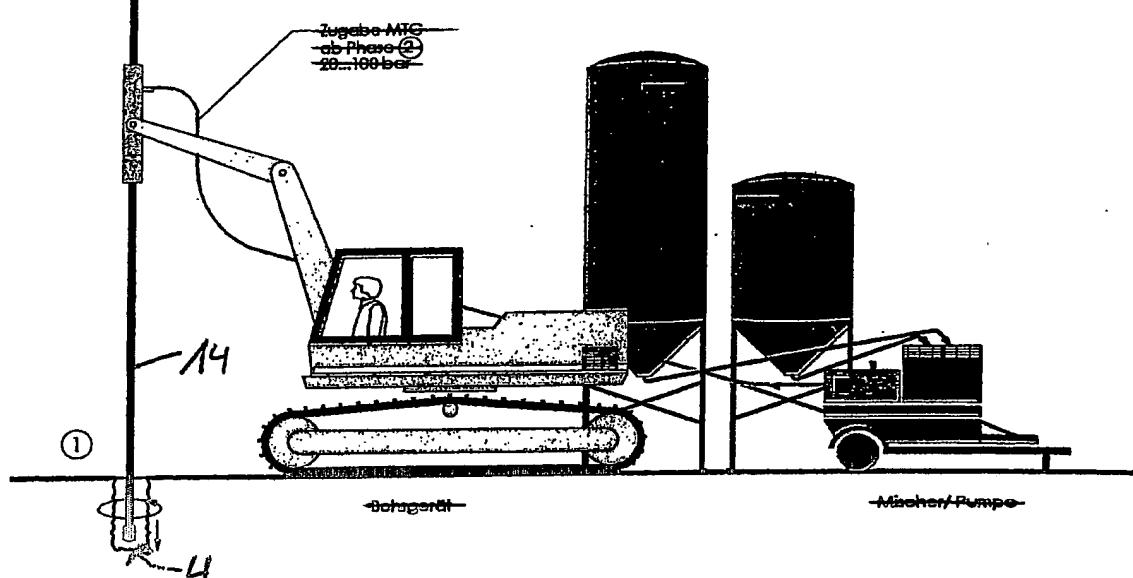


Fig 3

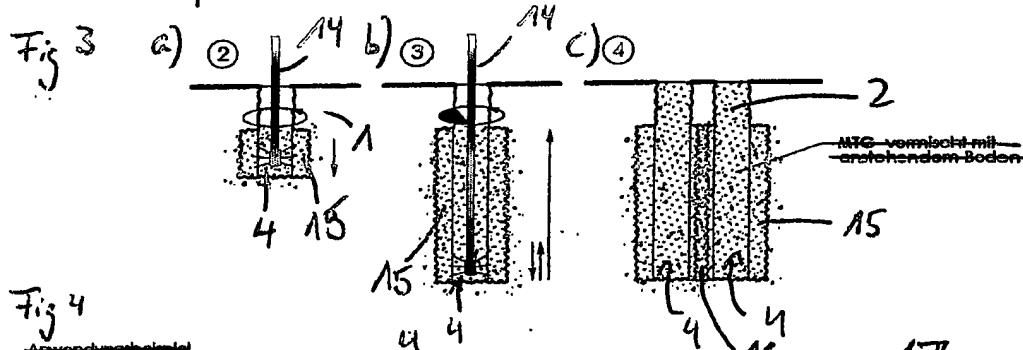
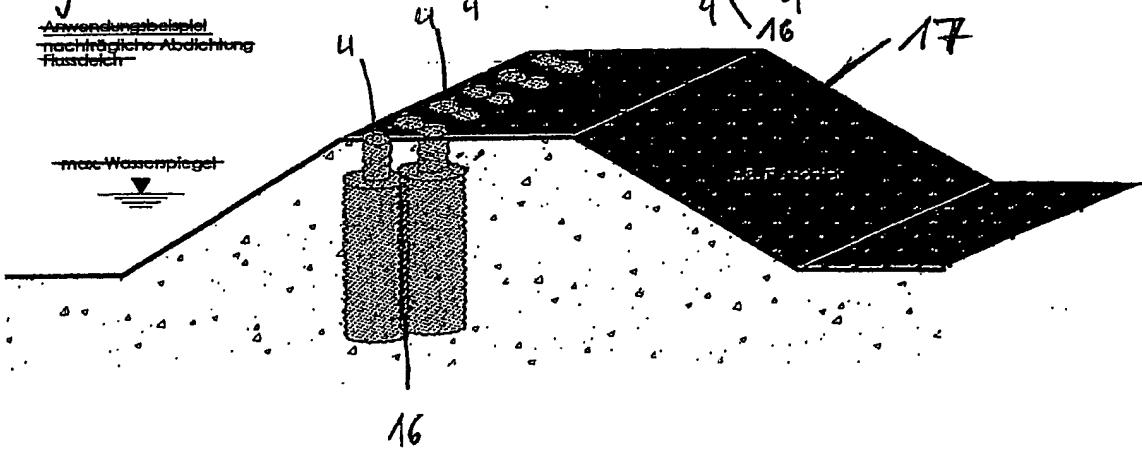


Fig 4



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Fig. 5

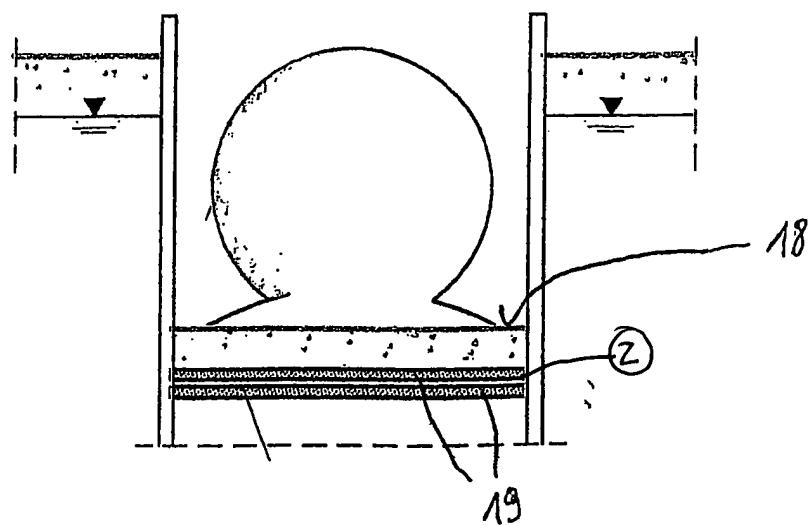


Fig. 6

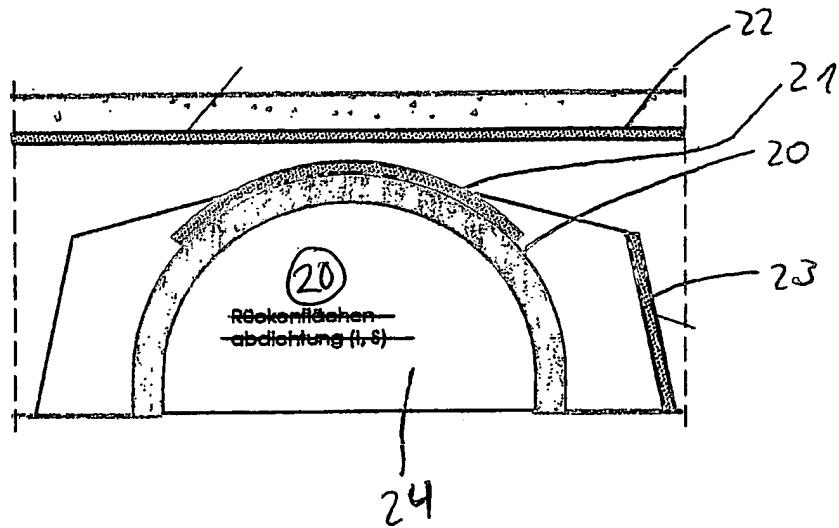
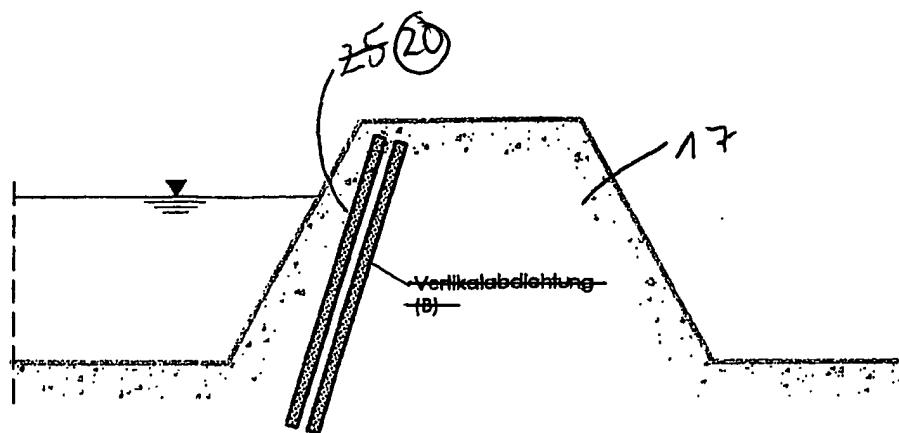


Fig. 7





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Substitute Specification Showing Changes

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MEANS AND METHOD FOR SEALING CONSTRUCTIONS

Background of the Invention

[0001] The invention concerns a means for and methods of sealing constructions, in particular earthwork constructions.

10 [0002] Means for and methods of sealing constructions, for example dams and dikes, which use concrete, for example water-impermeable concrete, as a sealing means, are known from the state of the art. The water-impermeable concrete can be introduced into already existing dikes through slot walls or bung bores. That procedure is disadvantageous however precisely in relation to dikes as a rigid body is formed

15 within the dike, which cannot compensate for shifts in the foundation soil so that breaks and cracks can occur in the concrete sealing means. Cracks in the sealing means however mean that the dike or generally the construction becomes water-permeable again and there is the risk of underscouring.

[0003] In comparison the use of argillaceous mixtures for sealing constructions, earlier known as 'puddle', affords the advantage that this kind of sealing does not form a

20 rigid sealing body so that shifts in foundation soil are compensated and no leaks can occur. Sealing arrangements for constructions comprising argillaceous mixtures involve water-impermeability of approximately the same level as sealing arrangements using concrete. Puddles on the dam outside are also relatively complicated and expensive,

25 require a great deal of construction material, destroy the biotop on the dam surface and do not have particularly long service lives. They are also limited to use in relation to dams or dikes which can be dry at least during the building phase.

Brief Summary of the Invention

[0004] In comparison with the state of the art the object of the invention is to

30 provide a means for and a method of sealing constructions, which permits new and already existing constructions to be flexibly, inexpensively and permanently sealed with a high degree of sealing integrity, by the introduction of a core sealing means.

[0005] That object is attained in that the means for sealing constructions comprises a mixture of argillaceous materials and an additive which breaks open the

enclosing water around the grain of the soil, wherein 1m³ of soil contains up to 0.5% by volume, preferably between 0.01% by volume and 0.1% by volume and particularly preferably 0.03% by volume of the additive. In comparison with the conventional argillaceous mixtures such as for example bentonite, that modified soil mixture exhibits

5 a substantially improved sealing action, wherein the flexible properties of the argillaceous mixtures from the state of the art are still retained. The quantitative ratio according to the invention between the additive and the soil achieves optimum water-impermeability. In that respect the concentration of the additive should not substantially exceed 0.5% by volume as, at higher levels of concentration, the additive has a film-forming effect around the soil.

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Brief Description of the Several Views of the Drawings

Figure 1 shows a diagrammatic representation of the soil exchange process,

Figure 2 shows a diagrammatic representation of the injection of mixture of soil and additive into a bore hole,

15 Figures 3a – c show diagrammatic representations of the stepwise procedure in the injection of the mixture of soil and an additive into a bore hole,

Figure 4 shows a lateral view in section through a river dike with bore holes,

Figure 5 shows a diagrammatic sectional view of a construction below ground level with surface sealing,

20 Figure 6 shows a diagrammatic sectional view of a tunnel construction with various sealing arrangements, and

Figure 7 shows a sectional view of a dike with vertical sealing.

Detailed Description of the Invention

25 [0006] Introduction of the additive according to the invention into the soil mixture, by virtue of the water casing which generally surrounds the individual grain being broken open, obviously results in better coagulation by virtue of the stronger adhesion forces with which the individual particles of the soil can adhere to each other after their water casing has been broken open. By virtue of using the additive in the

30 preferred embodiment of the invention, this provides that the mixture acquires a compact, viscous-plastic and water-impermeable consistency. Even after a forced drying-out operation the mixture remains stable and upon absorbing a small amount of

water immediately assumes again the viscous-plastic, water-impermeable consistency. Because of the strong cohesion between the grains, plant roots cannot pass through the sealing means, nor can it be infested by small animals. In addition adjunction works are possible at any time as the mixture does not set. Undermining and erosion of the
5 injection body in the case of flowing water does not occur.

10 [0007] In a preferred embodiment the additive is a polymer, in particular a polymeric (meth)acrylamide. When using polymeric additives K-values around 10^{-9} m/second are achieved. A possible explanation for achieving the high K-values could be the dense bedding of the soil constituents and the fact that the pores in the structure
15 are filled up by the clay particles.

15 [0008] In addition a particularly preferred embodiment of the invention is one in which the additive contains saponified paraffins. The use of the polymeric (meth)acrylamide in conjunction with saponified paraffins is ecologically harmless so that the sealing means can be used in all ground water zones. Because of the low level of concentration of the additive a binding agent function is not possible and desired and is also not effected by any cement or lime admixtures, the concentration of which would also be too low for that purpose. There is no chemical reaction with the additive, but it acts substantially with a hydrophobing effect on the grain. Its action is comparable to that of a catalyst.

20 [0009] It is desirable if the soil in the present invention contains clay and/or coarse clay. A proportion of at least 10% by weight, preferably at least 15% by weight of clay and/or coarse clay has proven to be particularly advantageous. It is precisely the fine-grain constituents such as clay or coarse clay in the soil that, in conjunction with the additive, permit the formation of a compact, viscous-plastic and water-impermeable
25 mass.

30 [0010] A preferred embodiment of the invention provides that a proportion of cement and/or lime which in turn contains a proportion of 1% by weight to 10% by weight, preferably 3.5% by weight of the additive, is added to the mixture. That addition is advantageous as it dilutes the additive and for example facilitates uniform distribution of the additive when injecting the mixture into an already existing construction. In that respect a particularly preferred embodiment of the invention is one in which between 15 kg and 25 kg, preferably 20 kg of the cement or lime containing

the additive, is added to one cubic metre of soil. That amount permits optimum dilution of the additive upon injection into an existing construction. Mixing of additive and cement and/or lime can take place at the factory, that is to say not on site.

[0011] In order to make the mixture capable of flow, it is desirable if a 5 proportion of between 20% by weight and 50% by weight, preferably between 25% by weight and 40% by weight and particularly preferably between 30% by weight and 35% by weight of water is added to the mixture. With that water content the mixture has thixotropic properties, that is to say the material can be pumped and conveyed but becomes jelly-like firm as soon as it comes to rest. After the excess water issues the 10 Proctor density of the mixture is reached, that is to say with that water content, optimum compacting of the soil and the additive is achieved.

[0012] In regard to the method the object of the invention is achieved in that a 15 mixture of soil and an additive, as has been described hereinbefore, is injected into a construction or is sprayed on at the surface using a wet flow method. That procedure makes it possible for an already existing construction to be sealed off subsequently, that is to say even years after it was constructed.

[0013] In a preferred embodiment of the invention firstly holes are bored into the construction, the hole walls being stabilised. The soil is then flushed out of the 20 walls of the holes and a mixture of soil and an additive as has been described hereinbefore is pressed into the hole. That method makes it possible for the additive to be introduced even into constructions whose soil is already so greatly compacted that the additive cannot be introduced through cavities and/or porous intermediate spaces in the soil.

[0014] In a particularly preferred embodiment the walls of the bore holes are 25 supported with a tube which has slots and the soil is flushed out through the slots and the mixture of soil and an additive as has been described hereinbefore is pressed into the construction through same or other adjacent slots or openings. Supporting the bore holes with a slotted tube prevents the walls of the bore holes falling in during the works and thus hindering the introduction of the sealing means into the construction. In that 30 case the slotted tube advantageously remains in the bore hole during all stages.

[0015] In a particularly preferred embodiment of the method of the invention the operation of flushing out the soil and the operation of introducing the mixture of soil and additive are effected in one working step.

[0016] Depending on the foundation soil composition it may be desirable if 5 additional substances with a high fine proportion, preferably clay and/or coarse clay, are added to the mixture of soil and an additive as has been described hereinbefore. That makes it possible for even constructions whose soil contains only small fine proportions to be subsequently very effectively sealed with the aforesaid method.

[0017] As an alternative to the specified method, in the case of injectable 10 grounds, it may be advantageous for the above-described additive to be directly injected into cavities, holes and/or into the porous intermediate spaces of the soil of the construction so that it mixes there with the soil. That method permits introduction of the additive into the construction with a low level of complication and expenditure.

[0018] In a preferred embodiment of the invention rotating boring lances are 15 used for injection of the mixture of soil and an additive in order to build up a cylindrical body of sealing material in the construction, with a defined injection pressure.

[0019] Further advantages, features and possible uses of the present invention will be apparent from the description hereinafter of a preferred embodiment and the 20 related Figures, in which:

- _____ Figure 1 shows a diagrammatic representation of the soil exchange process;
- _____ Figure 2 shows a diagrammatic representation of the injection of mixture of soil and additive into a bore hole;
- _____ Figures 3a - c show diagrammatic representations of the stepwise procedure in the injection of the mixture of soil and an additive into a bore hole;
- _____ Figure 4 shows a lateral view in section through a river dike with bore holes;
- _____ Figure 5 shows a diagrammatic sectional view of a construction below ground level with surface sealing;
- _____ Figure 6 shows a diagrammatic sectional view of a tunnel construction with various sealing arrangements, and
- _____ Figure 7 shows a sectional view of a dike with vertical sealing.

[0020] Figure 1 diagrammatically shows the exchange of the soil 1 by a mixture of the previously removed soil 1 and an additive 3. In the illustrated embodiment the additive used is a polymeric acrylamide in conjunction with saponified paraffins. That additive can be obtained under the trade name Consolid. Water is introduced into a 5 slotted tube 4 under high pressure through a conduit 5 so that the soil is flushed out at the slots 6 of the tube. The mixture of soil and water is then sucked away from the slotted tube 4 by way of a conduit 7. After settlement in a settlement tank 8 the mixture of soil and water is mixed in a mixer 9 with parts of the drilling material 10 and the additive 3. Soil can possibly be mixed in the mixer with a higher fine proportion, for 10 example coarse clay and/or clay. The modified clay mixture is then passed by way of a further conduit 12 back into a region 13 under the removal location of the slotted tube 4, under pressure. There it is used for filling the wall region 6 from which soil 1 was previously flushed out. In a concluding working operation, the slotted tube 4 is drawn out of the bore hole and the bore hole is filled with the modified clay mixture 2.

15 [0021] Figure 2 diagrammatically shows the step of injecting the modified clay mixture with an additive, here Consolid, and optionally additional fine components, into a bore hole 4. For that purpose a hole 4 is bored with a rotating boring lance 14 and at the same time the modified clay mixture 2 is pressed thereinto.

[0022] That can be particularly clearly seen in Figures 3a – c. Figures 3a and b 20 show how the modified clay mixture is pressed into the bore hole during the operation of boring the hole with the lance 14. It can be seen in this respect how the modified clay mixture 2 also penetrates into the soil 1 in the regions 15 directly adjoining the bore hole 4.

[0023] Figure 3c shows two mutually juxtaposed bore holes 4 which are already 25 filled with the modified clay mixture 2. Their edge or surrounding regions 15 which are also penetrated by the modified clay mixture overlap in a region 16 so that in cross-section there is a continuous sealing surface formed from the modified clay mixture.

[0024] Figure 4 particularly clearly shows the formation of a continuous sealing 30 surface within a river dike. The choice of the arrangement of the bore holes 4 provides respective overlapping surrounding regions 6 around the bore holes, which are permeated by the sealing mixture, so that an interruption-free sealing arrangement in an

already existing dike can be built up without having to excavate the dike over its entire length.

[0025] Figure 5 shows an underground construction, the bottom surface 18 of which has been sealed with two sealing surfaces 19 of the modified clay mixture 2.

5 [0026] Figure 6 shows a tunnel, the rear surface 20 of which has been provided in the upper region with a seal 20 of the modified clay mixture 2. In addition it is also possible to see a seal 22 of modified clay mixture 2, which covers over the region of the tunnel tubes and the adjacent earth. Such cover arrangements are frequently used in the field of underground railway construction in which further traffic levels are arranged
10 over the tunnel tubes. A further seal 23 in the region laterally of the tunnel tubes 24 can prevent for example ground water from penetrating into the tunnel tubes 24.

[0027] Figure 7 shows a so-called vertical seal 20 of a dike 17. For that purpose slots are excavated into the dike perpendicularly to the top thereof, in this case two slots, the slots being filled with the modified clay mixture 2 to seal off the dike 17.

Abstract

~~The present invention relates to a means for and a~~ A method of sealing constructions. In order to provide a means for and a method of sealing constructions which permits flexible, inexpensive and permanent sealing of new and already existing constructions, with a high degree of sealing integrity, by introducing a core sealing means, it is proposed in accordance with the invention that the means for sealing constructions comprises a mixture of soil, preferably argillaceous materials and/or coarse clay, and an additive for breaking open the enclosing water around the grain. In regard to the method it is proposed that the mixture of soil and an additive is injected into the construction or is sprayed on at the surface.

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and covered by a metal plate bolted or riveted to the vessel.

soft phosphate [MATER] Powdery, impure tricalcium phosphate separated in fertilizer manufacture from rock and pebble phosphates.

soft point [ORD] A bullet with a soft point, intended to spread upon striking a target with some resistance, such as the flesh of game; not permitted in combat operations.

soft radiation [PHYS] Radiation whose particles or photons have a low energy, and, as a result, do not penetrate any type of material readily.

soft rime [HYD] A white, opaque coating of fine rime deposited chiefly on vertical surfaces, especially on points and edges of objects, generally in supercooled fog.

soft rock [MIN ENG] Rock that can be removed by air-operated hammers, but cannot be handled economically by a pick. [PETR] 1. A broad designation for sedimentary rock.

2. A rock that is relatively nonresistant to erosion.

soft rot [PL PATH] A mushy, watery, or slimy disintegration of plant parts caused by either fungi or bacteria.

soft-shell disease [INV ZOO] A disease of lobsters caused by a chitinous bacterium which extracts chitin from the exoskeleton.

soft shower [NUC PHYS] A cosmic-ray shower that cannot penetrate 15 to 20 centimeters of lead; consists mainly of electrons and positrons.

soft solder [MET] Solder composed of an alloy of lead and tin. Also known as low melting solder.

soft soldering [MET] Soldering with a soft solder.

soft tube [ELECTR] 1. An x-ray tube having a vacuum of about 0.000002 atmosphere (0.02650 newton per square meter), the remaining gas being left in intentionally to give less-penetrating rays than those of a more completely evacuated tube. 2. See gassy tube.

software [ADP] The totality of programs usable on a particular kind of computer, together with the documentation associated with a computer or program, such as manuals, diagrams, and operating instructions.

software monitor [ADP] A system, used to evaluate the performance of computer software, that is similar to accounting packages, but can collect more data concerning usage of various components of a computer system and is usually part of the control program.

soft waste [TEXT] The waste from yarn manufacturing prior to spinning, including some spinning waste; usually reprocessed in the mill.

soft water [CHEM] Water that is free of magnesium or calcium salts.

soft wood [MATER] Wood from a coniferous tree.

soft x-ray [ELECTROMAG] An x-ray having a comparatively long wavelength and poor penetrating power.

soft x-ray absorption spectroscopy [SPECT] A spectroscopic technique which is used to get information about unoccupied states above the Fermi level in a metal or about empty conduction bands in an inoculator.

soft x-ray appearance potential spectroscopy [SPECT] A branch of electron spectroscopy in which a solid surface is bombarded with monochromatic electrons, and small but abrupt changes in the resulting total x-ray emission intensity are detected as the energy of the electrons is varied. Abbreviated SXAPS.

sogasoid [PHYS] A system of solid particles dispersed in a gas.

Sohn Abyssal Plain [GEOL] A basin in the North Atlantic, about 2400 fathoms deep, between Newfoundland and the Mid-Atlantic Ridge.

Sohncke's law [PHYS] The law that the stress per unit area normal to a crystallographic plane needed to produce a fracture in a crystal is a constant characteristic of a crystalline substance.

soil [GEO] 1. Unconsolidated rock material over bedrock.

2. Freely divided rock-derived material containing an admixture of organic matter and capable of supporting vegetation.

soil air [GEOL] The air and other gases in spaces in the soil; specifically, that which is found within the zone of aeration. Also known as soil atmosphere.

soil atmosphere See soil air.

soil blister See frost mound.

soil-cement [MATER] A compacted mixture of soil, cement, and water used as a base course or surface for roads and airport paving.

soil chemistry [GEOCHEM] The study and analysis of the inorganic and organic components and the life cycles within soils.

soil colloid [GEOL] Colloidal complex of soils composed principally of clay and humus.

soil complex [GEOL] A mapping unit used in detailed soil surveys; consists of two or more recognized classifications.

soil conservation [ECOL] Management of soil to prevent or reduce soil erosion and depletion by wind and water.

soil creep [GEOL] The slow, steady downhill movement of soil and loose rock on a slope. Also known as surficial creep.

soil erosion [GEOL] The detachment and movement of topsoil by the action of wind and flowing water.

soil flow See solifluction.

soil fission See solifluction.

soil formation See soil genesis.

soil genesis [GEOL] The mode by which soil originates, with particular reference to processes of soil-forming factors responsible for the development of true soil from unconsolidated parent material. Also known as pedogenesis; soil formation.

soil mechanics [ENG] The application of the laws of solid and fluid mechanics to soils and similar granular materials as a basis for design, construction, and maintenance of stable foundations and earth structures.

soil microbiology [MICROBIO] A study of the microorganisms in soil, their functions, and the effect of their activities on the character of the soil and the growth and health of plant life.

soil moisture See soil water.

soil physics [GEOPHYS] The study of the physical characteristics of soils; concerned also with the methods and instruments used to determine these characteristics.

soil pipe [CIV ENG] A vertical cast-iron or plastic pipe for carrying sewage from a building into the soil drain.

soil profile [GEOL] A vertical section of a soil, showing horizons and parent material.

soil rot [PL PATH] Plant rot caused by soil microorganisms.

soil science [GEO] The study of the formation, properties, and classification of soil; includes mapping. Also known as pedology.

soil series [GEOL] A family of soils having similar profiles, and developing from similar original materials under the influence of similar climate and vegetation.

soil shear strength [GEOL] The maximum resistance of a soil to shearing stresses.

soil stabilizer [MATER] A chemical that alters the engineering property of a natural soil; used to stabilize soil slopes; to prepare for building foundations, and to prevent erosion.

soil stack [BUILD] The main vertical pipe into which flows the waste water from all fixtures in a structure.

soil stripes [GEOL] Alternating bands of fine and coarse material in a soil structure.

soil structure [GEOL] Arrangement of soil into various aggregates, each differing in the characteristics of its particles.

soil survey [GEOL] The systematic examination of soils, their description and classification, mapping of soil types, and the assessment of soils for various agricultural and engineering uses.

soil thermograph [ENG] A remote-recording thermograph whose sensing element may be buried at various depths in the earth.

soil thermometer [ENG] A thermometer used to measure the temperature of the soil, usually the mercury-in-glass thermometer. Also known as earth thermometer.

soil water [HYD] Water in the belt of soil water. Also known as rhizic water; soil moisture.

soil-water belt See belt of soil water.

soil-water zone See belt of soil water.

sol [CHEM] A colloidal solution consisting of a suitable dispersion medium, which may be gas, liquid, or solid, and the colloidal substance, the disperse phase, which is distributed throughout the dispersion medium.

Sol See sun.